Peak Service Study
Northwest Rail

We make lives better through connections.

Milestone 4 – Peak Service Expansion Concepts Technical Report

August 2024

Regional Transportation District
1660 Blake Street, Denver CO 80202

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Introduction

The objective of Milestone 4 (MS4) is to consider potential service expansion opportunities for the Base Configuration for Northwest Rail Peak Service. The Base Configuration is the service plan for commuter rail as defined by the RTD Board of Directors with input from stakeholders in the Northwest Corridor. RTD identified several potential service expansion opportunities that could be feasible and meet the needs identified during the public and stakeholder engagement process.

The Peak Service Base Configuration

The Base Configuration service concept was defined by the RTD Board of Directors and stakeholders as three morning peak trips from Longmont to Denver and three evening peak trips from Denver to Longmont with six new stations and with service operating in place of the three trips morning and three evening peak trips on the existing B Line service. Since the Base Configuration Service Concept would include stops at existing B Line stations, existing B Line trains would be replaced by Northwest Rail trains operating three trains thirty minutes apart during each peak period and on a compatible schedule with the overall B Line service.

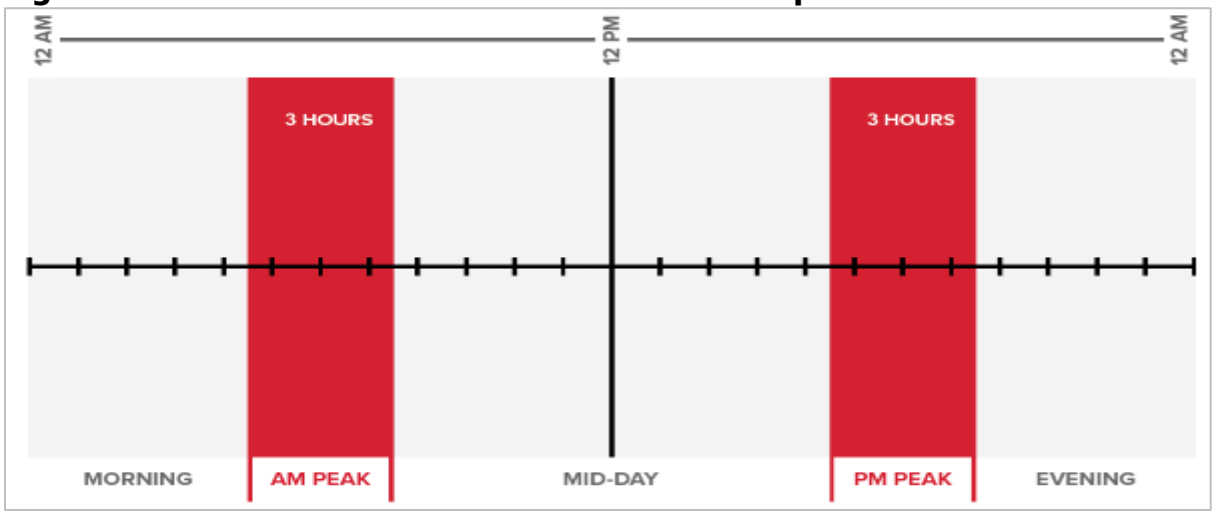
The Base Configuration was refined in Milestone 3 (MS3) to define the infrastructure required for the service concept to operate. The Project Team developed the infrastructure requirements based on track improvements required to achieve a travel time goal of 65 minutes (+/-2 minutes) between Longmont and Denver Union Station (DUS), including stops and dwell times at intermediate stations. In addition, MS3 defined land and infrastructure requirements for stations, midday storage and maintenance and storage facility requirements, freight passing sidings required by BNSF, and safety, signals, communications, and crossing improvements required to operate commuter rail on a freight rail line. The Project Team identified a midday storage facility north of Westminster/72nd Station, enabling the Northwest Rail peak service trains to replace the full roundtrips of existing B Line trains between Westminster/72nd and DUS during peak periods while avoiding additional conflicts into and out of Union Station.

In addition to service and infrastructure requirements, MS3 identified the design considerations under which RTD would acquire an easement from BNSF for the exclusive operations of commuter rail service during peak hours without potential conflicts with freight rail operations. BNSF has developed a standard format of multiple agreements through which it partners with regional transit agencies who provide commuter rail service on BNSF tracks. The Project Team considered the potential costs and cost effectiveness of operating additional service within time blocks that would be acquired from BNSF to operate the peak service versus additional service that would require negotiating and acquiring additional time blocks from BNSF.

Figure 1 illustrates the access easement time block concept required for peak period, peak direction Northwest Rail service. Red blocks illustrate service periods dedicated solely for RTD passenger rail use, while gray blocks represent the remaining periods for use by BNSF and potentially intercity rail services. Two time blocks of just over two hours each are required to operate Northwest Rail Peak Service; however, RTD has identified

a three-hour time block to allow for any non-revenue movements to occur and to allow for a modest expansion of service.

Figure 1. Access Easement "Time Block" Concept



Source: RTD; HDR; June 2024

Factors Considered for Expanded Service

In evaluating options for expanded service, the Project Team considered what the community and stakeholders said in the engagement process, the potential for intercity rail service by Front Range Passenger Rail (FRPR) to complement peak service, and the potential cost and cost effectiveness of options for expanded service. The Project Team also considered that US 36 Flatiron Flyer service and the SH 119 Bus Rapid Transit service would provide parallel service to most communities and stations along the Northwest Rail corridor during congested peak periods as service during less-congested weekday off-peak periods and on weekends when Northwest Rail Peak Service is not operating.

Community Feedback

The Project Team led an extensive public and stakeholder engagement process that informed the development of the Base Configuration on a full range of service and infrastructure issues, as well as impacts and benefits of the service. Public meeting and online participants were also asked, "How can Peak Service be enhanced to better meet your needs and expectations?" Nearly 300 participants responded, and the summary of responses to this question are shown in Table 1.

Table 1. "How can Peak Service be enhanced to better meet your needs and expectations?"

Survey Responses	Percent	Potential Solution
Add weekend service	27%	Intercity Rail Service
Offer reverse direction train in the peak hour	20%	Expanded Peak Service Trains
Improve first/last mile connections	12%	Improved Bus Connections
Add service to major events	10%	Intercity Rail Service or Special Peak Service Trains
Add evening service	10%	Intercity Rail Service or Existing US 36/SH 119 Bus Service
Add midday service	10%	Intercity Rail Service
Other responses	11%	Varies

Source: HDR; April-July 2024

The addition of weekend service was the most desired service enhancement, followed by reverse commute service during peak periods. Assuming that RTD Northwest Rail Peak Service and FRPR Intercity Rail Service both operated in the corridor, the Project Team identified in Table 1 the service types that would likely meet the needs desired by potential users.

Any RTD service operated outside the weekday peak windows identified would require one or more additional easements with BNSF and would be more likely to interfere with both freight and intercity rail service. Therefore, expansion alternatives focused on providing one or two reverse commute trains during the three-hour time blocks in each peak period. Train operations modeling is required to identify exactly where the inbound and outbound trains would meet to provide a passenger siding track.

Expanded Service Options

Consistent with other freight corridors that host both commuter and intercity passenger rail service, weekend, midday, and evening service are often provided by the intercity rail service, while peak period service is primarily provided by commuter rail. For that reason, and because any additional reverse direction peak period commuter rail service would operate within the existing peak period times, the Project Team focused its Expanded Service Options on meeting the need for reverse commute trips.

Up to two trains could operate in the reverse peak direction within the two three-hour easement periods RTD would acquire from BNSF. This would permit each peak period to provide up to two round trips and one one-way trip. The Project Team evaluated two alternatives: Expansion Alternative One with one peak round trip and two one-way trips, and Expansion Alternative Two with two peak round trips and one one-way trip. The two expanded service options shown in Table 2 build modestly on the Base Configuration.

Table 2. Preliminary Conceptual Service Expansion Alternatives

Service Description	Base Configuration	Expansion Alternative One: One Reverse Commute Train	Expansion Alternative Two: Two Reverse Commute Trains	Weekend Service
Morning Peak Longmont to Denver	3 Train Trips	3 Train Trips	3 Train Trips	Intercity Rail
Morning Peak	3 Train Trips	2 Trains End 1 Train Continues	1 Train Ends 2 Trains Continue	Intercity Rail

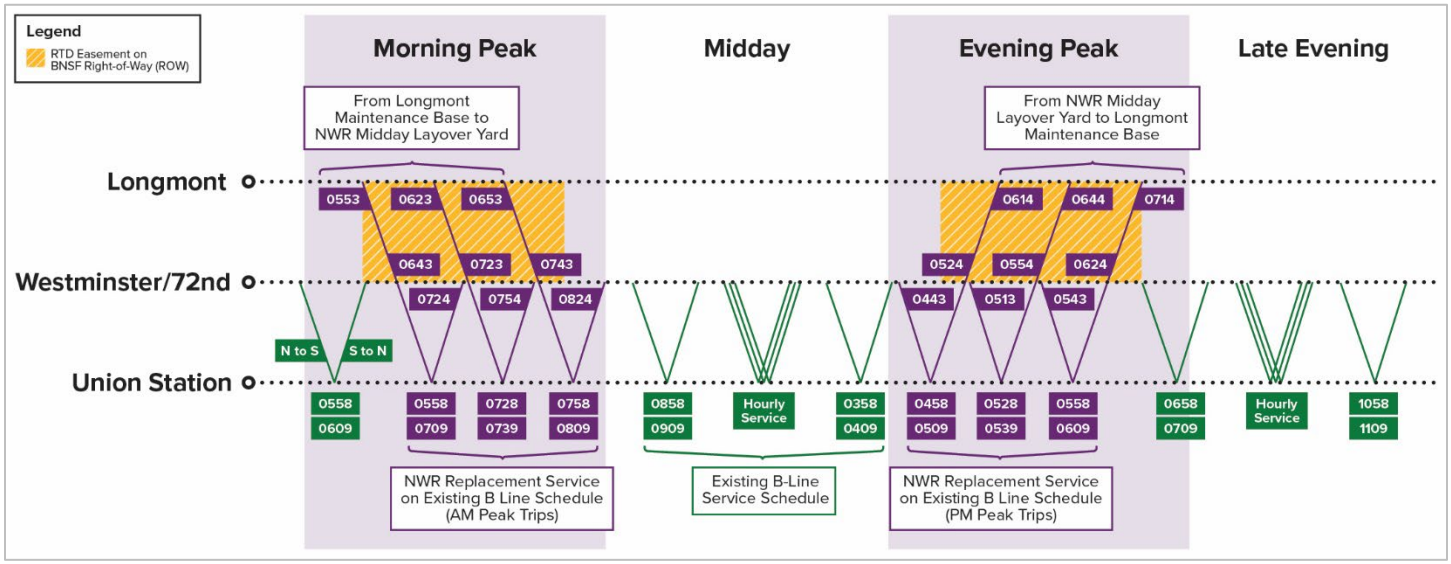
Service Description	Base Configuration	Expansion Alternative One: One Reverse Commute Train	Expansion Alternative Two: Two Reverse Commute Trains	Weekend Service
Denver to Westminster/72nd				
Morning Peak Denver to Longmont	No Train Service	1 Train Trip	2 Train Trips	Intercity Rail
Midday Round Trips	Intercity Rail	Intercity Rail	Intercity Rail	Intercity Rail
Evening Peak Longmont to Denver	No Train Service	1 Train Trip	2 Train Trips	Intercity Rail
Evening Peak Westminster/72nd to Denver	3 Train Trips	2 Trains Start 1 Train Continues	1 Train Starts 2 Trains Continue	Intercity Rail
Evening Peak Denver to Longmont	3 Train Trips	3 Train Trips	3 Train Trips	Intercity Rail
Late Evening Round Trips	Intercity Rail	Intercity Rail	Intercity Rail	Intercity Rail

Source: RTD, HDR; June-July 2024 Note: Intercity rail service is contingent on implementation by other agencies.

Descriptions of Conceptual Service Expansion Alternatives

The Base Configuration shown in Figure 2 illustrates the three morning peak trips from Longmont to Denver with a reverse revenue movement along the existing B Line to a midday storage facility north of Westminster/72nd Station, and the evening peak service begins with a reverse commute revenue movement from Westminster/72nd Station to Denver and returning in the evening peak direction to Longmont.

Figure 2. Schematic Schedule for Peak Service Base Configuration in Northwest Corridor

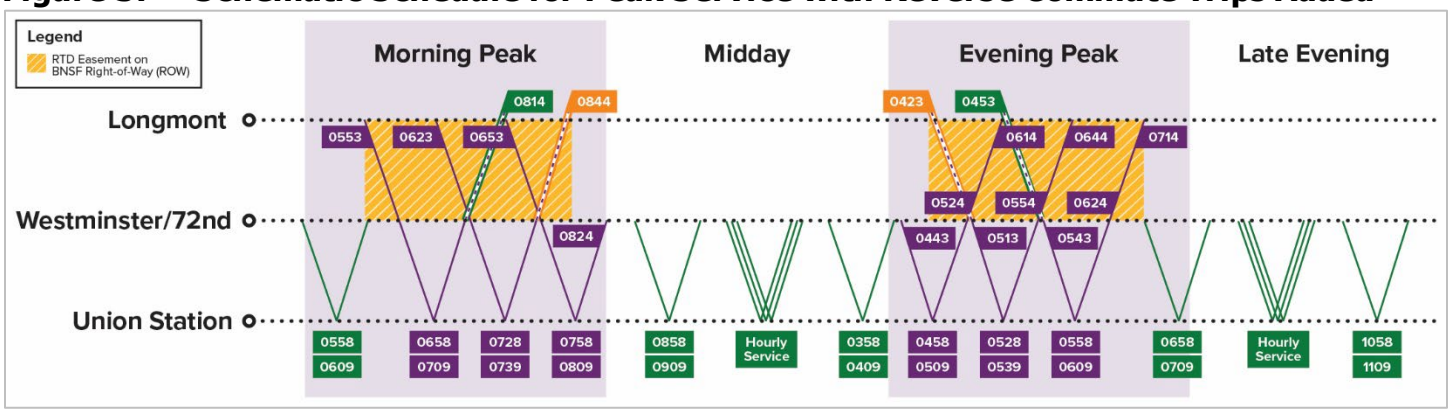


Source: RTD; HDR; May 2024

Expansion Alternative 1 extends one of the reverse commute trains from Westminster/72nd Station to Longmont and eliminates the need for midday storage of one train. This train may remain in the Longmont Station during the day, or it may return to the Northwest Rail Commuter Rail Maintenance Facility (RMF) before making its evening peak round trip from Longmont to Denver and back. To allow for both peak direction and reverse commute trains to operate, a passenger passing track would need to be constructed south of Broomfield/116th Station (this passing track would serve both Expansion Alternatives 1 and 2). Expansion Alternatives 1 and 2 are shown in Figure 3.

Expansion Alternative 2 extends two of the reverse commute trains from Westminster/72nd Station to Longmont and eliminates the need for midday storage of two trains. Trains would remain at the Longmont Station during the day before returning to make two evening peak round trips from Longmont to Denver and back. This option would eliminate the need to expand existing storage tracks at Westminster/72nd Station, since the existing storage tracks have the capacity to store one Northwest Rail Peak Service Train and leave a turnaround track for the B Line electric trains.

Figure 3. Schematic Schedule for Peak Service with Reverse Commute Trips Added

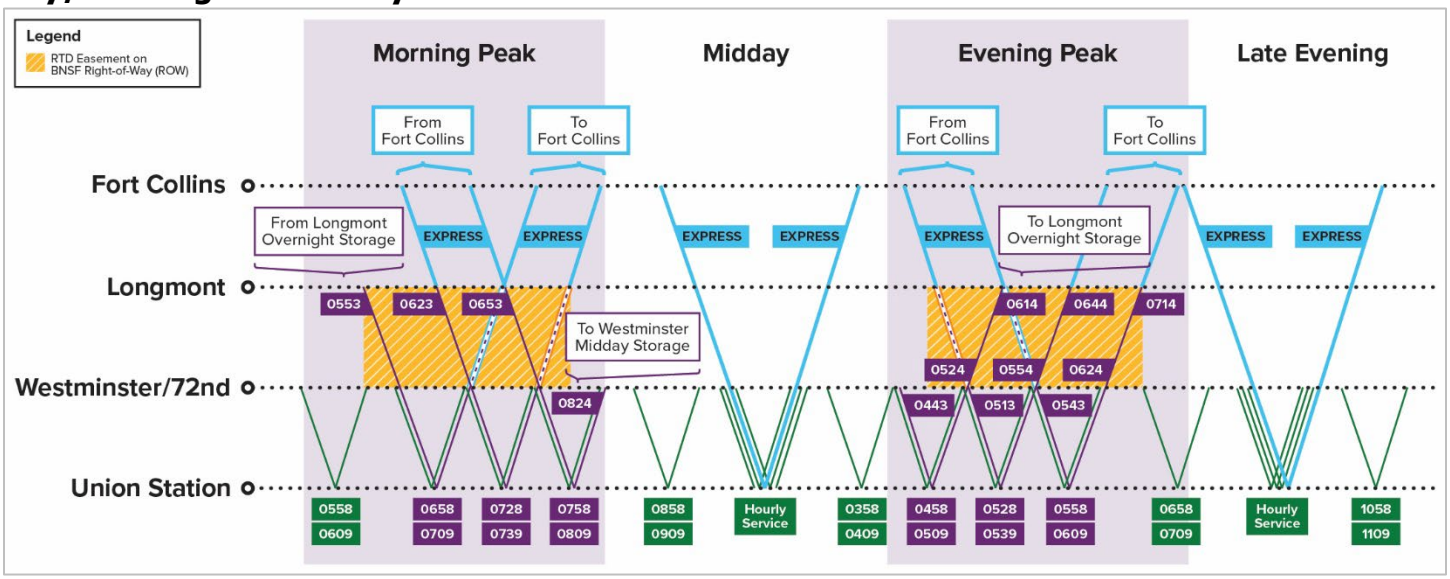


Source: RTD; HDR; May 2024

Additional train modeling, coupled with a bus schedule analysis, would be required to determine whether train schedules would meet typical commute schedules for employment destinations along the corridor. Providing an earlier departure from Denver to Longmont may be possible if a train can be stored overnight at Denver Union Station; however, both security and capacity concerns would need to be assessed.

Figure 4 illustrates how intercity rail alternatives shown in Table 2 might operate in the corridor to supplement RTD's Northwest Rail Peak Service trains. As of the time of this report, the Front Range Passenger Rail District (FRPRD) has not determined an operating schedule for its services.

Figure 4. Schematic Schedule for Peak Service with Reverse Commute and Mid-Day/Evening Services by Others



Source: RTD; HDR; May 2024

Analysis of Conceptual Service Expansion Alternatives

The technical analysis of possible expansion options was conducted using a train operations software model called Rail Traffic Controller (RTC). Train operations in the model were simulated on an infrastructure configuration based on the track layout and geometry of BNSF's Front Range Subdivision from Longmont, through Boulder that leads to a connection with the RTD B Line north of the Westminster – 72nd Street Station. From there, the model track infrastructure follows RTD's B Line from Westminster Station at 72nd Street to Denver Union Station.

RTD established a travel time goal from Longmont to Union Station of 65 minutes plus/minus 2 minutes. The planned train speeds along the route were then established by RTD and previous rail simulation modeling was performed to develop the run-time.

Plans for the existing rail infrastructure and the added improvements in the Base Configuration were provided to the modeling team to build the line's track infrastructure into the RTC model. The most recently developed

30% preliminary engineering level plans prepared by BNSF Railway for implementing the RTD Northwest Rail commuter service were used.

Components built into the model specifically for the Peak Service commuter rail project included:

- Locations and track work associated with new commuter rail stations along the BNSF Front Range Subdivision
- Locations and track work providing access to a Northwest Rail commuter Rail Maintenance Facility (RMF) in Longmont
- Locations and track work providing access to a RTD NWR Midday Layover facility at the Westminster Station
- Locations and track configurations for all three of the proposed new passing sidings along the BNSF Front Range Subdivision to support the implementation of Northwest Rail commuter service
- Location and track configuration of connecting track at Westminster Station between the BNSF Front Range Subdivision and the RTD B Line to be used by Northwest Rail commuter trains
- No signal-controlled sections were assumed in the model

The next steps began with building train files to simulate the movement of the proposed RTD Northwest Rail commuter trains in the model under the Base Configuration plan of three one-way weekday morning trips from Longmont to Union Station and three one-way weekday evening trips from Union Station to Longmont. Train files include a schedule for the train's trip, the equipment to be used, and associated characteristics (e.g., train length, train weight). The technical report *"RTD Northwest Rail Peak Service Study Vehicle, Travel Time & Operating Plan Support Task 4 – Simulation Results for Greenbox & Westminster Options"*, Hatch/LTK; April 17, 2023, was used to integrate the B Line operating plan and schedule from Westminster Station to and from Union Station.

This plan support work also included the G Line operations along the two-track segment from Pecos Junction to Union Station which is another component in the overall operating plan. The current B Line and G Line weekday train schedules were used with the Base Configuration service plan.

The Base Configuration proposes to replace six peak period B Line round trips operated by Denver Transit Operators (DTO) to preserve capacity at DUS platforms. With this replacement, no additional impacts to existing services would be incurred from the proposed Service Expansion Alternatives.

Nonrevenue train movement information was used detailing the proposed nonrevenue movement of Northwest Rail trainsets to and from storage/maintenance facilities. It was also necessary to build train files to simulate the movement of scheduled weekday RTD G Line and B Line commuter trains between Pecos Junction and Union Station in the model to harmonize Northwest Rail train operations with RTD commuter train operations on the RTD-owned segment of the Northwest Rail line.

Equipment characteristics for the B Line and G Line commuter trains was used from RTD data for the current Hyundai-Rotem fleet (vehicle type, number of cars, train length, train weight). For the Peak Service commuter rail service, Stadler DMU vehicles in three-car trainsets were used in this analysis.

The output was train schedules for Northwest Rail, B Line, and G Line (to and from Denver-Pecos Junction only) commuter trains. A train performance chart was output to show the operating profile for the commuter train. A third product was output of stringline diagrams depicting one typical weekday of Northwest Rail commuter, B Line, and G Line train operations along the Northwest Rail Line route.

The modeling team analyzed the following alternatives for adding service in two different service types:

- Base Configuration Commuter Rail by RTD
    - The Base Configuration requested by the RTD Board of Directors is the primary model run. It is composed of the three inbound peak runs in the morning and three outbound runs in the evening.
    - Expansion Alternative 1 is built from the Base Configuration but includes a reverse peak service run within the morning and evening "time block" windows allotted for Northwest Rail commuter trains on the BNSF Front Range Subdivision. The first train in each peak is the train that runs the reverse service.
    - Expansion Alternative 2 is the same as the previous two alternatives, but a second reverse peak service run was added to the time block window. In this case, the two earliest runs are those that reverse.
- In any model run, no freight trains were assumed to be in the segment. If freight trains happened to be in the segment, BNSF dispatch would shunt the freight train(s) into one of the three new passing sidings.

Additional assumptions for the conceptual analysis included:

- New Northwest Rail commuter trains would make the same station stops and have the same trip times as Base Configuration service Northwest Rail trains
- New Northwest Rail commuter trains were planned to operate in conformance with the established service patterns of existing B Line between Westminster and DUS
- New frequencies were planned that utilize the three trainsets proposed for the Northwest Rail base commuter service; no additional equipment should be required to implement the additional reverse commute service.
- For both Expansion Alternatives, the first train (Expansion Alternatives 1 and 2) or first two trains (Expansion Alternative 2) in each peak were assumed to provide the reverse commute service. The return time for these trains would coincide with the start of day/end of day in the Boulder and Longmont areas.

- If the reverse commute operations were implemented, the first inbound and first outbound trains would meet in the segment between the 116th/Broomfield and Downtown Westminster stations near a BNSF Milepost labeled "Homestead". The second reverse commute in Expansion Alternative 2 would meet the last peak service train in the approximately six-mile B Line section between Union Station and Westminster. This is a double-track section so no layover in a siding would be needed for either direction.
- Minimum equipment-turn times of 11 minutes at Union Station and 20 minutes at the Longmont endpoint stations were assumed.

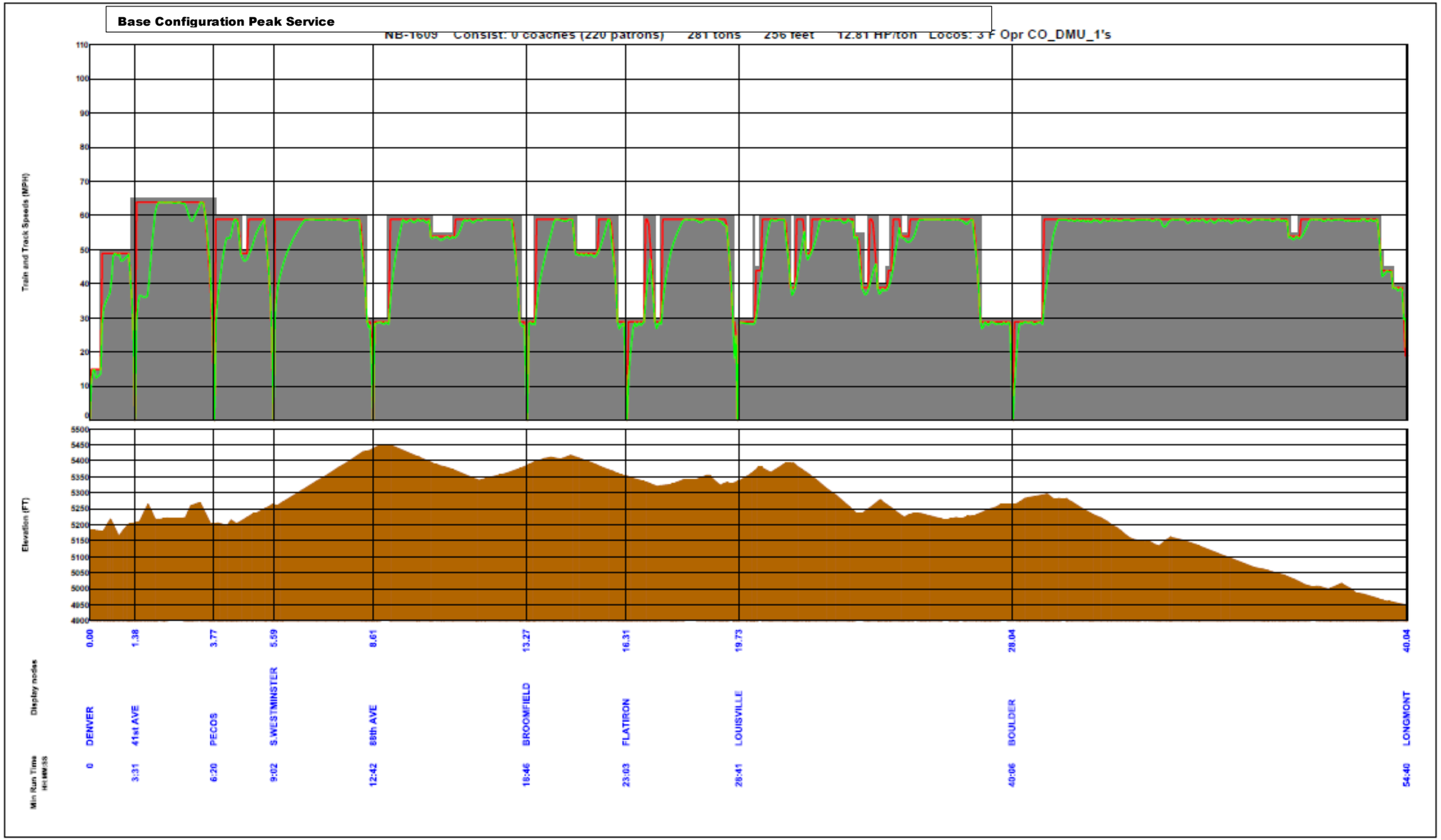
Run-time, Train Performance, and Stringline Results

Run-time tables using Excel were prepared for the Base Configuration and the two expansion alternative operating plans. The RTC model produced a train performance profile for Base Configuration as illustrated in Figure 5 and Figure 6 for Northbound (outbound) and Southbound (inbound) trips respectively. Dwell times and track speeds from the previous model runs by RTD were used in the simulation.

The run-time tables are presented in the Appendix followed by the associated stringline diagrams. The run-time tables show the departure times for each station, and the arrival time at the Westminster Station mid-day layover location. The reverse commute trains show the run-time for returning to Longmont as well.

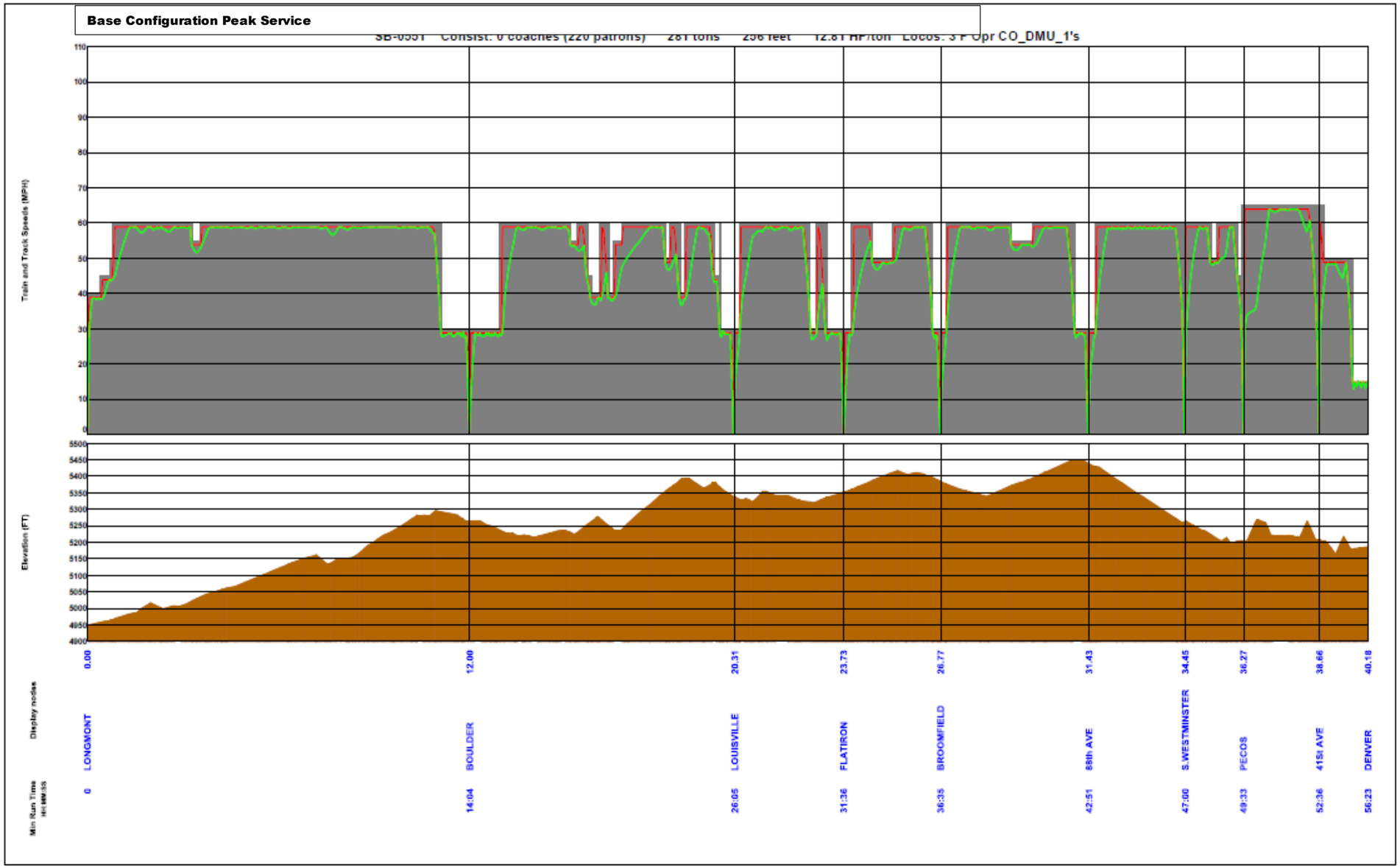
The simulation provides output of train track-miles and train-hours for use in estimating operating and maintenance costs. Those calculations are provided at the bottom of each run-time table. The tables also have listed trains by letter (A, B, C) or by departure time (e.g. SB-0550). In all three of the simulations for commuter rail, the service can be provided by three operating train sets, so no additional equipment is needed for any of the expansion commuter rail alternatives.

Figure 5. Train Performance Profile for Base Configuration - Northbound



Case: RTD_NW_EXT_ALT_1A RTC run: 11 June 2024 9:13:11 User: Glenn Millage of HDR

Figure 6. Train Performance Profile for Base Configuration – Southbound



Case: RTD_NW_EXT_ALT_1A RTC run: 11 June 2024 9:12:18 User: Glenn Millage of HDR

Observations of the run-times and the stringlines are summarized following:

- Commuter Rail Base Configuration
    - The base configuration operation is for 3 consecutive train runs from Longmont to DUS designed such that the train schedules on the RTD controlled segment between the existing Westminster Station and DUS would be the same as the current B-Line schedule. The timing of the Longmont to Westminster Station commuter rail trip is set to meet the established B Line schedules to complete the run to DUS.
- Commuter Rail Expansion Alternative 1
    - Alternative 1 includes one reverse train in the AM and PM time blocks.
    - The first morning southbound train, Train A, is the train that reverses to reach Boulder at 8:00 AM and Longmont at 8:15 AM
    - This schedule results in one additional train-meet of the northbound train, northbound Train A with the third southbound train, Train C at the segment between Downtown Westminster and 116th/Broomfield Stations. The meeting could be timed to occur at the 116th/Broomfield station and that section built with a double track segment for the passenger trains.
    - Because the reverse commute used the first morning train "A" equipment, it arrives in Longmont at 8:15. The total window of morning commuter rail operations on the BNSF freight line would be slightly more than two and a half hours, during which time freight trains would either not be scheduled to operate within the NWR segment or would be held in a siding.
    - The morning and the afternoon Peak Service Base Configuration schedules could be run in a three-hour block of time to allow for any variability setting the basis for the Access Easement from BNSF Railway
- Commuter Rail Expansion Alternative 2
    - In this alternative the first northbound train, Train A, and the third southbound train, Train C meet at the same point as Expansion Alternative 1 between Downtown Westminster and 116th/Broomfield.
    - The second northbound train, "B" would not have a meet with southbound trains and would not require any additional infrastructure than would be required in Alternative 1.
    - In the sketch plan-level train modeling, this operating pattern is shown to take up just over three full hours for the morning and afternoon peak periods. Refinement of the run times, dwell times and other assumptions in the model can tighten up the operating window in future planning work.

Cost Estimates

Capital costs and operating and maintenance (OPEX) estimates were calculated using the stringline diagrams as inputs. The O&M costs are expressed as a range from the least amount of service in the Base Configuration to the highest levels of commuter rail service for Expansion Alternative 2.

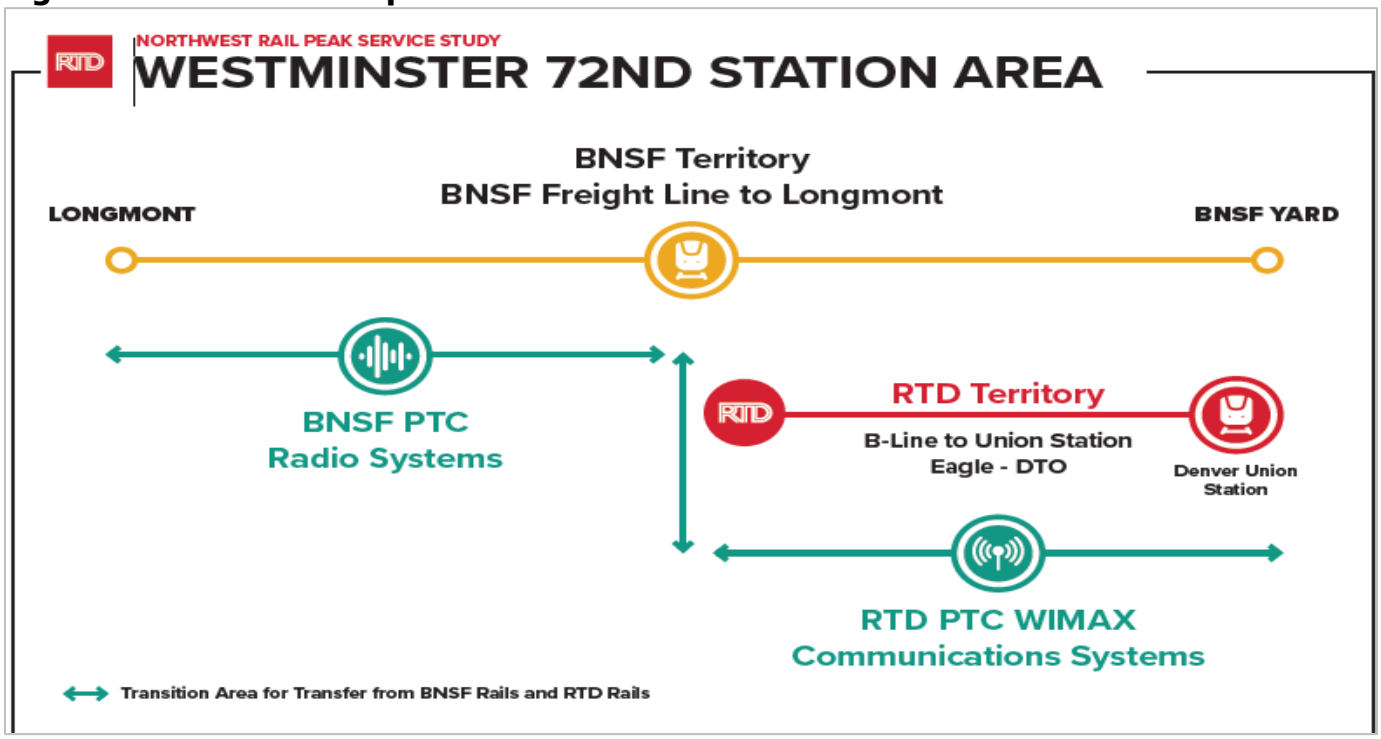
- RTD Staff Operates Service (OPEX cost model based on 2022 NTD data using annual vehicle-car hours)
    - Base Configuration: $12 M – $14 M
    - Expansion Alternative 1: $15 M - $18 M
    - Expansion Alternative 2: $18 M - $21 M
- Contracted estimate based on NorthStar commuter rail system in Minneapolis region that is operated by BNSF (based on annual vehicle-car hours)
    - Base Configuration: $16 M - $18 M
    - Expansion Alternative 1: $18 M - $20 M
    - Expansion Alternative 2: $20 M - $22 M

Operations and Dispatch Coordination

The PTC technology in use by RTD and BNSF will require a concept of operations implementation plan. For the Northwest Rail commuter rail trains, the PTC and voice communication system for inbound trains will need to transition from BNSF territory to the RTD territory. Similarly, the PTC and voice communication system for outbound trains will need to transition from RTD to the BNSF territory.

Both the respective RTD and BNSF PTC systems will need to be installed in parallel and potentially activated simultaneously in each territory. The overlap area shown in Figure 7 would be a transition area that must be implemented for continuous PTC coverage. The details and implementation of this transition area will be dependent on who is selected to operate the railroad, i.e., RTD, a third-party contractor or BNSF. The PTC transition area is at the end of RTD track and beginning of a staging or transition area at the Westminster–72nd Station Tail Track.

Figure 7. PTC and Dispatch Transition Area



Source: HDR; April 2024 Done

Because commuter rail would run only during the peak periods, those time blocks provide clear delineation of which party is responsible for the dispatch and control requirements. When defining the Peak Service concept of operations, it will be important to not preclude consideration of midday, evening and weekend RTD and/or intercity service.

Conclusions

The Base Configuration would need to add a new commuter rail siding to allow up to two reverse commute peak period train trips to operate within the proposed time block acquired from BNSF. Infrastructure changes include a passenger passing track south of Broomfield/116th Station and a possible reduction or elimination of required improvements for the midday train storage area at Westminster/72nd.

Initial sketch planning suggests that up to two round trips can be operated within the 3-hour time block that would be acquired from BNSF. This would allow three peak period, peak direction trains and two peak period, reverse peak trains to operate each peak period. Moreover, the added service can be operated with the same fleet that operates peak direction trains; thus, no additional trains would need to be acquired.

A more detailed analysis of train operations, including detailed modeling, is required to validate findings. Updated travel demand forecasts are also needed to assess the reverse commute ridership potential for expanded service options.

The actual cost to operate reverse peak commuter rail service may be slightly lower than the estimate, depending on minimum paid time guaranteed to operators (e.g. the minimum time guarantee may be

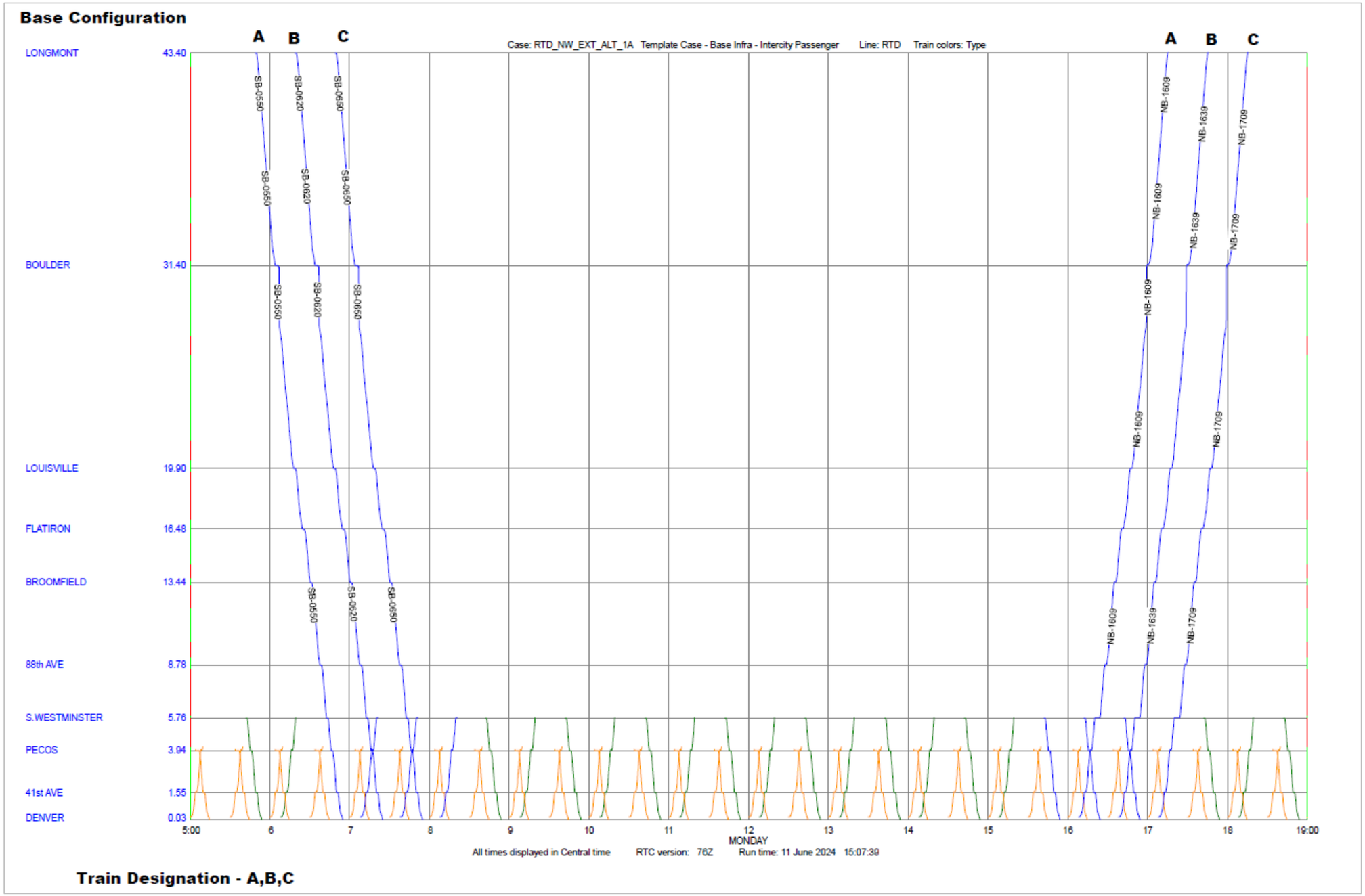
sufficient for the operator to make a full round trip without impacting the labor costs required to operate a one-way service). For this analysis, average overall operating cost per train hour reported to the National Transit Database (NTD) have been used.

Appendix 1
Base Configuration

LONGMONT to DENVER UNION STATION

Base	Configuration							
		Total Runtime	01:08	01:08	01:08			
		Equipment ⇨	A	B	C	A	B	C
mi			SB 0550	SB 0620	SB 0650	SB 1543	SB 1613	SB 1643
43.4	LONGMONT	dep	05:50	06:20	06:50	-	-	-
31.4	BOULDER	dep	06:06	06:36	07:06	-	-	-
19.9	LOUISVILLE	dep	06:19	06:49	07:19	-	-	-
16.5	FLATIRON	dep	06:25	06:55	07:25	-	-	-
16.5	BROOMFIELD	dep	06:31	07:01	07:31	-	-	-
8.8	88th AVE	dep	06:38	07:08	07:38	-	-	-
5.8	WESTMINSTER	dep	06:43	07:13	07:43	15:43	16:13	16:43
3.9	PECOS	dep	06:45	07:15	07:45	15:45	16:15	16:45
1.6	41st AVE	dep	06:49	07:19	07:49	15:49	16:19	16:49
0.0	UNION STATION	arrv	06:58	07:28	07:58	15:58	16:28	16:58
			↓	↓	↓	↓	↓	↓
		Layover	00:11	00:11	00:11	00:11	00:11	00:11
			↓	↓	↓	↓	↓	↓
			NB 0709	NB 0739	NB 0809	NB 1609	NB 1639	NB 1709
0.0	UNION STATION	dep	07:09	07:39	08:09	16:09	16:39	17:09
1.6	41st AVE	dep	07:13	07:43	08:13	16:13	16:43	17:13
3.9	PECOS	dep	07:17	07:47	08:17	16:17	16:47	17:17
5.8	WESTMINSTER	arrv	07:24	07:54	08:24	-	-	-
5.8	WESTMINSTER	dep	-	-	-	16:24	16:54	17:24
8.8	88th AVE	dep	-	-	-	16:29	16:59	17:29
16.5	FLATIRON	dep	-	-	-	16:36	17:06	17:36
16.5	BROOMFIELD	dep	-	-	-	16:41	17:11	17:41
19.9	LOUISVILLE	dep	-	-	-	16:48	17:18	17:48
31.4	BOULDER	dep	-	-	-	17:00	17:30	18:00
43.4	LONGMONT	arrv	-	-	-	17:15	17:45	18:15
			↓	↓	↓			
			SB 1543	SB 1613	SB 1643			
		Road Miles	49.2	49.2	49.2	49.2	49.2	49.2

A	98.4
B	98.4
C	98.4
Total	295.2

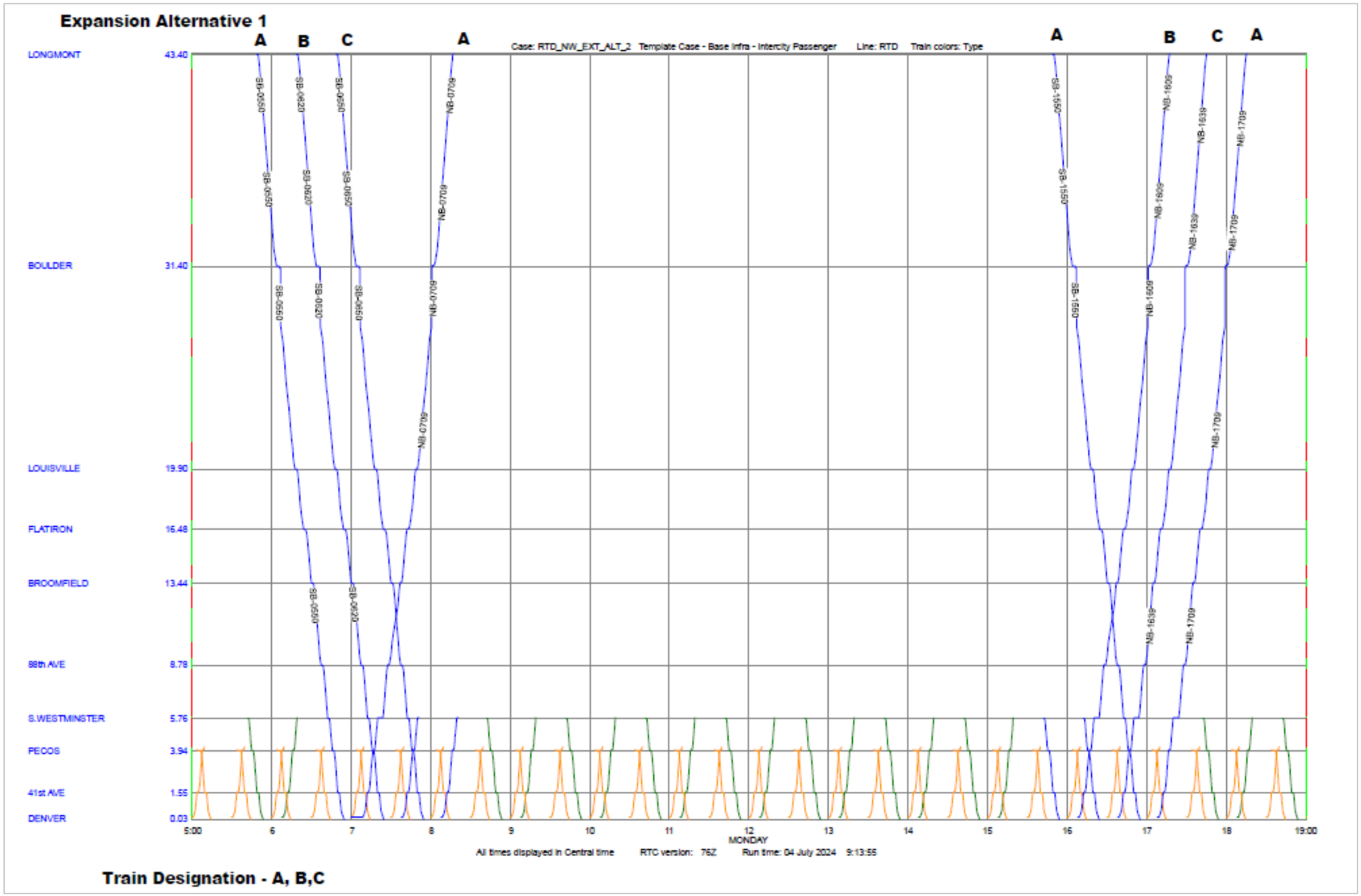

Base Configuration
A
B
C
Case: RTD_NW_EXT_ALT_1A Template Case - Base Infra - Intercity Passenger
Line: RTD
Train colors: Type
LONGMONT 43.40
BOULDER 31.40
LOUISVILLE 19.90
FLATIRON 16.48
BROOMFIELD 13.44
88th AVE 8.78
S.WESTMINSTER 5.76
PECOS 3.94
41st AVE 1.55
DENVER 0.03
SB-0550
SB-0620
SB-0650
NB-1609
NB-1639
NB-1709
5:00
6
7
8
9
10
11
12
13
14
15
16
17
18
19:00
MONDAY
All times displayed in Central time
RTC version: 76Z
Run time: 11 June 2024 15:07:39
Train Designation - A,B,C

Appendix 2
Expansion Alternative 1

LONGMONT to UNION STATION

Expansion	Alternative 1	Equipment ⇨	A	B	C	B	C	A
mi			SB 0550	SB 0620	SB 0650	SB 1543	SB 1613	SB 1550
43.4	LONGMONT	dep	05:50	06:20	06:50	-	-	15:50
31.4	BOULDER	dep	06:06	06:36	07:06	-	-	16:06
19.9	LOUISVILLE	dep	06:19	06:49	07:19	-	-	19:19
16.5	FLATIRON	dep	06:25	06:55	07:25	-	-	16:25
16.5	BROOMFIELD	dep	06:31	07:01	07:31	-	-	16:31
8.8	88th AVE	dep	06:38	07:08	07:38	-	-	16:38
5.8	WESTMINSTER	dep	06:43	07:13	07:43	15:43	16:13	16:43
3.9	PECOS	dep	06:45	07:15	07:45	15:45	16:15	16:45
1.6	41st AVE	dep	06:49	07:19	07:49	15:49	16:19	16:49
0.0	UNION STATION	arrv	06:58	07:28	07:58	15:58	16:28	16:58
			↓	↓	↓	↓	↓	↓
		Layover	00:11	00:11	00:11	00:11	00:11	00:11
			↓	↓	↓	↓	↓	↓
			NB 0709	NB 0739	NB 0809	NB 1609	NB 1639	NB 1709
0.0	UNION STATION	dep	07:09	07:39	08:09	16:09	16:39	17:09
1.6	41st AVE	dep	07:13	07:43	08:13	16:13	16:43	17:13
3.9	PECOS	dep	07:17	07:47	08:17	16:17	16:47	17:17
5.8	WESTMINSTER	arrv	-	07:54	08:24	-	-	-
5.8	WESTMINSTER	dep	07:24	-	-	16:24	16:54	17:24
8.8	88th AVE	dep	07:29	-	-	16:29	16:59	17:29
16.5	FLATIRON	dep	07:36	-	-	16:36	17:06	17:36
16.5	BROOMFIELD	dep	07:41	-	-	16:41	17:11	17:41
19.9	LOUISVILLE	dep	07:48	-	-	16:48	17:18	17:48
31.4	BOULDER	dep	08:00	-	-	17:00	17:30	18:00
43.4	LONGMONT	arrv	08:15	-	-	17:15	17:45	18:15
			↓	↓	↓	↓	↓	↓
			SB 1550	SB 1613	SB 1550			
	Road Miles	**Road Miles**	86.8	49.2	49.2	49.2	49.2	86.8

A	173.6
B	98.4
C	98.4
Total	370.4


Expansion Alternative 1
A
B
C
A
Case: RTD_NW_EXT_ALT_2 Template Case - Base Infra - Intercity Passenger
Line: RTD
Train colors: Type
LONGMONT
43.40
BOULDER
31.40
LOUISVILLE
19.90
FLATIRON
16.48
BROOMFIELD
13.44
88th AVE
8.78
S.WESTMINSTER
5.76
PECOS
3.94
41st AVE
1.55
DENVER
0.03
SB-0550
SB-0620
SB-0650
NB-0709
NB-1609
NB-1639
NB-1709
SB-1559
5:00
6
7
8
9
10
11
12
MONDAY
13
14
15
16
17
18
19:00
All times displayed in Central time
RTC version: 75Z
Run time: 04 July 2024 9:13:55
Train Designation - A, B,C

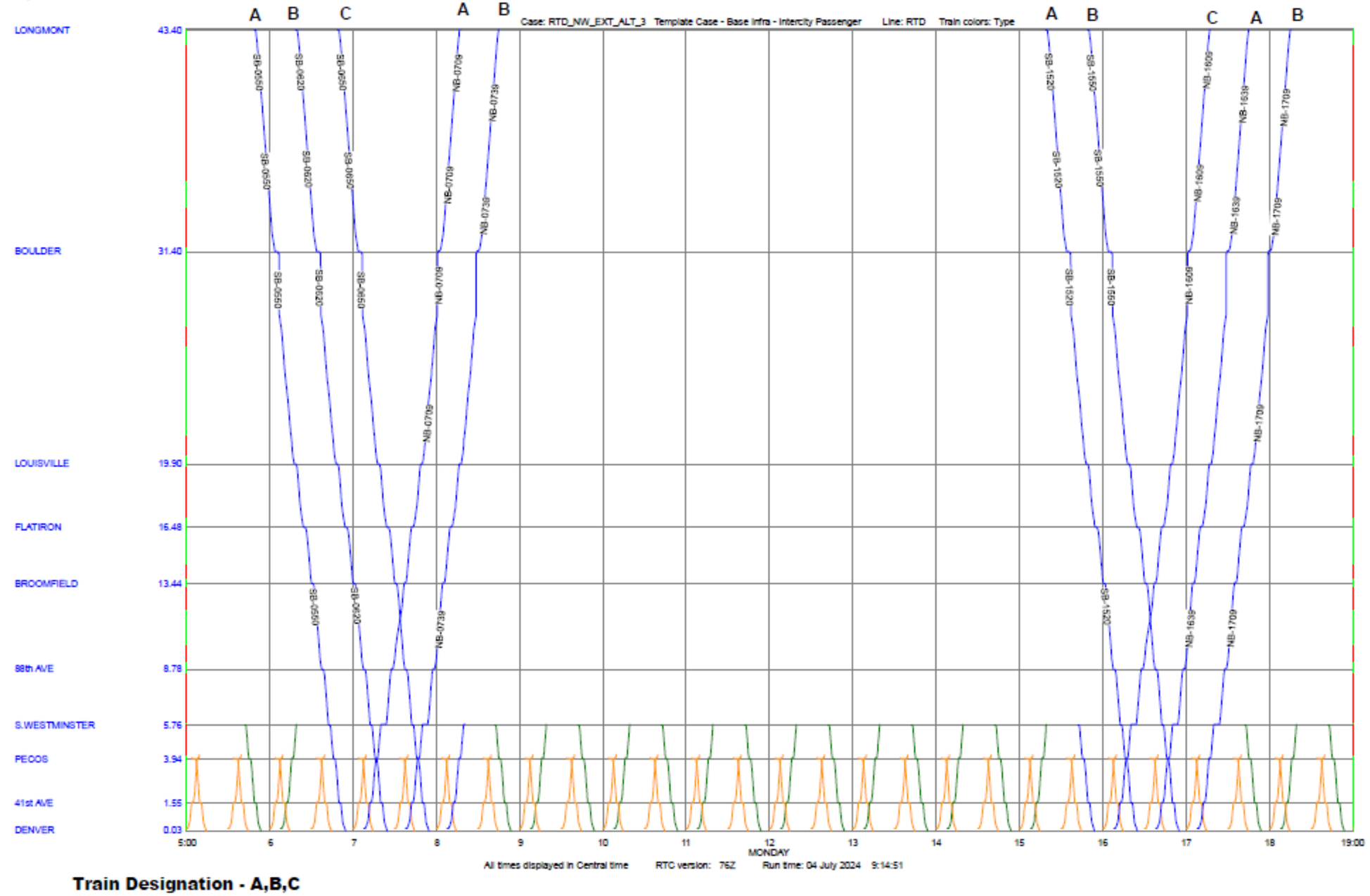
Appendix 3
Expansion Alternative 2

LONGMONT to DENVER STATION

Expansion	Alternative 2	Equipment ⇨	A	B	C	C	A	B
mi			SB 0550	SB 0620	SB 0650	SB 1543	SB 1520	SB 1550
43.4	LONGMONT	dep	05:50	06:20	06:50	-	15:20	15:50
31.4	BOULDER	dep	06:06	06:36	07:06	-	15:36	16:06
19.9	LOUISVILLE	dep	06:19	06:49	07:19	-	15:49	16:19
16.5	FLATIRON	dep	06:25	06:55	07:25	-	15:55	16:25
16.5	BROOMFIELD	dep	06:31	07:01	07:31	-	16:01	16:31
8.8	88th AVE	dep	06:38	07:08	07:38	-	16:08	16:38
5.8	WESTMINSTER	dep	06:43	07:13	07:43	15:43	16:13	16:43
3.9	PECOS	dep	06:45	07:15	07:45	15:45	16:15	16:45
1.6	41st AVE	dep	06:49	07:19	07:49	15:49	16:19	16:49
0.0	UNION STATION	arrv	06:58	07:28	07:58	15:58	16:28	16:58
			↓	↓	↓	↓	↓	↓
		Layover	00:11	00:11	00:11	00:11	00:11	00:11
			↓	↓	↓	↓	↓	↓
			NB 0709	NB 0739	NB 0809	NB 1609	NB 1639	NB 1709
0.0	UNION STATION	dep	07:09	07:39	08:09	16:09	16:39	17:09
1.6	41st AVE	dep	07:13	07:43	08:13	16:13	16:43	17:13
3.9	PECOS	dep	07:17	07:47	08:17	16:17	16:47	17:17
5.8	WESTMINSTER	arrv	-	-	08:24	-	-	-
5.8	WESTMINSTER	dep	07:24	07:54	-	16:24	16:54	17:24
8.8	88th AVE	dep	07:29	07:59	-	16:29	16:59	17:29
16.5	FLATIRON	dep	07:36	08:06	-	16:36	17:06	17:36
16.5	BROOMFIELD	dep	08:41	08:11	-	16:41	17:11	17:41
19.9	LOUISVILLE	dep	07:48	08:18	-	16:48	17:18	17:48
31.4	BOULDER	dep	08:00	08:30	-	17:00	17:30	18:00
43.4	LONGMONT	arrv	08:15	08:45	-	17:15	17:45	18:15
			↓	↓	↓	↓	↓	↓
			SB 1520	SB 1550	SB 1543			
		Road Miles	86.8	86.8	49.2	49.2	86.8	86.8

A	173.6
B	173.6
C	98.4
Total	445.6

Expansion Alternative 2



Train Designation - A,B,C